Title: Patterns: Patterning Our Way To Savings!

Brief Overview:

In these lessons, students will be identifying and using patterns in order to solve problems. They will be using an authentic problem that will engage them in their task. They will use and identify patterns in calendars, t-charts, graphs, and hundreds charts.

NCTM Content Standard:

Algebra-Understanding Patterns
- describe, extend, and make generalizations about geometric and numeric patterns
- represent and analyze patterns and functions, using words, tables, and graphs.

Grade/Level:

This lesson is intended for the third grade.

Duration/Length:

Three 50-60 minute lessons

Student Outcomes:

Students will:

- Identify, describe, extend, and create numeric patterns and functions by skip counting by twos, fives and tens.
- Complete a function table using a given addition rule.
- Make numeric and graphic representations of their data.

Materials and Resources:

Teacher Resource Pages-1, 8, 9, 12, 13, 14, 18, 19, 23, 26
Student Resource Pages- 2, 3, 4, 5, 6, 7, 10, 11, 15, 16, 17, 20, 21, 22, 24,25
Red and Blue Crayons for each student
Large chart paper and graph paper (optional)
Transparency paper (optional)
Literature Connection for Launch (optional)
A Hundreds Chart for each student

Development/Procedures:

Lesson 1
Preassessment

- Hand out a hundreds chart to students in groups of 4. Tell them that for the next 2 minutes they will be identifying any patterns they can find in the hundreds chart.
- After two minutes, have a brief discussion with the students allowing each group to share one of the patterns they found. For example, odd and even patterns, place value patterns, counting by five and ten patterns.
- As a class, discuss the definition of a pattern. <u>Pattern</u>: a regular, orderly repetition of numbers, shapes, pictures, movements, etc.

Launch

- Teacher may begin lesson with a literature connection about chores or saving money. This will help students become engaged in the lesson. If no book is available, simply use the prompt attached (Resource 1).
- Discuss with students the importance of doing chores and earning money. Talk about things they like to buy with their money. Tell them that over the next few days, they will be using patterns to figure out how to save money to purchase certain items.
- Begin by showing students the prompt and have students brainstorm different ways to solve the problem.

Teacher Facilitation

- Distribute the calendar for January (Resource 2), and model how to write down how much money was saved throughout the week (see model calendar-Resource 9). Remind students that Johnny is only doing chores during the week. Therefore, they should not fill out the calendar for Saturday and Sunday. Model the answering of questions with students (Resource 3 and Resource 8)
- Do the same for each of the next three weeks. Have the students look at their calendar and the totals at the end of each week and see if they notice a pattern.
- Talk about how much time it takes to actually fill out the calendar, and ask if there would be an easier way to find the weekly totals without filling out each day.
- Guide the students to realize that they can just put $5.00 as the weekly totals, and count by fives to find the total savings.
- Discuss how knowing and using a pattern, helps them save time while keeping track of their money.

Student Application

- Next, have the students apply the new information about patterns to another calendar (February-Resource 4,5,8). Allow students five minutes to fill out the calendar and questions.
- After they are finished, have them discuss with their groups any patterns they found and used. Teacher will guide a class discussion allowing each group to share their information.
- Next, explain to the students that if Johnny does both his sister's chores 5 days a week as well as his, he will earn $2.00 per day.
- Hand out another calendar (March-Resource 6 ,7,8) and complete week one as a large group. Let students complete the remaining weeks in pairs. Have them analyze the complete totals in order to identify a pattern. Give them ten minutes to complete the calendar and questions.
- Collect finished papers to use as an assessment. However, discuss all questions as a large group when every child is finished.

Embedded Assessment

- Teacher should be looking for an understanding and the ability to identify patterns in the weekly totals. This can be done through observation during both group and individual work, discussion, and whole class responses. Also, the final calendar will be collected to identify how well the students grasped the concept.

Reteaching/Extension

- Allow students who have not yet seen or understood the pattern to continue using the calendar as a tool by filling out each day and counting to find the weekly totals. Also use a hundreds chart to help them see the pattern. Fill in the weekly savings totals on the hundreds chart and identify the pattern.
- Have students figure out the patterns for future weeks without using a calendar. Encourage them to explain the pattern and how it saves them time in calculating the total savings.

Lesson 2

Preassessment:

- Have a brief discussion with the class about the patterns they saw yesterday with the calendars. They should still have all of the calendars with them in order to complete today's activities. Be sure that every child understands and can complete the patterns from the previous day. Discuss with them the different patterns that occurred while creating each of the calendars of savings. Refer back to the hundreds chart to visually show the patterns for those who are having trouble.

Launch:

- Discuss with students how long it took them to complete each of the calendars by filling it in one day at a time. Ask questions: how could you make this process quicker, and how can you save time when figuring out how much money you made. Have a brief discussion about how they keep track of their money. Do they keep track of their money? How do they plan and save in order to purchase certain things?

Teacher Facilitation:

- Introduce the T-Chart to the students. They should be very familiar with these charts from using them across the curriculum. Explain to them that we can use this table to record our information on weekly savings. Go over the parts of the function table. The input side is for the term (or week) and the output side is for the weekly total savings.
- Pass out the worksheet for this lesson (Resource Sheet 10 and 11). The answer key is Resource Sheet 12. As a whole group, fill out the function table for the month of January, allowing students to discuss how to fill it in. Allow them to use their calendars to help them fill in the table. Guide them to the correct format. After filling it in, have them answer the questions below the table with their group. Go over the questions in a whole group setting.

Student Application:

- Next, allow the students to practice what they have learned by filling in the table for the month of February. It will look exactly the same as the month of January. Walk around the room and make sure students are filling out the table properly. Redirect any students who may need extra help. Challenge them to fill out the table without using their calendars.
- Take student answers in order to fill out the table on the board. Then, have them answer the questions, using the original prompt to help them answer the questions. Let students discuss in small groups, and then come back to large group and correctly answer the questions.

- Last, have the students complete the table for the month of March. They should do this on their own, as well as answering the questions independently. Once this is collected, the teacher may discuss the answers with the students in order to ensure understanding

Embedded Assessment:

- Teacher will make observations throughout the lesson by looking at their work, listening to their answers, and monitoring group discussions.
- Teacher will also collect a final assessment of the table and questions for March.

Reteaching/Extension:

- For students who need extra support, they will be able to continue using their calendars to record their information and will also have access to a hundreds chart to help them see the patterns.
- Students who are grasping the concept will be encouraged to continue the patterns for future weeks and should not use the calendars to find the patterns. Also encourage them to find the rule for the table (they can just multiply by 5). Last, they can change the amount he earns each day and create other function tables.

Lesson 3
Preassessment

- Have students complete a problem on the board where they will be asked to make a function table. The problem will read as follows: David buys a pencil from school each day for four weeks. Make a function table to show how many total pencils David will buy in four weeks? The function tables should be set up as follows:

Week	Total Pencils
1	
2	
3	
4	

  Now, complete a function table assuming David buys 2 pencils a day for four weeks.

- After students have completed both function tables have two students come to the board and write their tables. Discuss any questions and/or problems.

Launch

- Explain to students that yesterday they used a function table to organize their information and to determine a pattern. Show the example of the function table for January created for Johnny. Ask students some questions about the function table:
  - How many weeks will it take Johnny to earn $15.00?
  - If Johnny works for 5 weeks how much money will he earn?
  - If Johnny wants to buy something that costs $50.00 how long is it going to take him to save enough money? ($50.00 is not represented in their table)
- Have students brainstorm in their groups as to how they can figure how long it will take Johnny to save $50.00. Discuss the results that students find. If not given as an answer, guide students to realize that a graph can be drawn to find the answer.

Teacher Facilitation

- Briefly review with students the rules for making graphs (need title, labels, increments, key).
- Show students the correlation between the terms in the function graph and the coordinates on the graph. The input column becomes the x coordinate and the output column becomes the y coordinate. Show examples to students of how to use the function table and create the coordinates for the graph.

- On the board show students how to make a graph from January's function table (answer key Resource 13). Label the *x*-axis Total Savings and the y-axis Number of Weeks. Graph the points up until week four. Now, show how you can draw a line and find out how much he will make in the following weeks.
    - How many weeks does it take to have a savings of $50.00. See sample graph for help.
    - How long will it take Johnny to save $60.00?
    - How much money will Johnny make in 8 weeks/10 weeks?
- Pass out February graph (Resource 15, answer key Resource 14) paper to the students. The graph is labeled and set up for them. With the students, guide them through creating a graph using the February Function Chart. After the four weeks have been plotted, have students use a ruler to extend the line further on the graph. Show students how to use that line to see how long it will take Johnny to earn different amounts. Have them answer questions based on the graph that is created together with the teacher.
    - How many weeks will it take Johnny to earn $40/$45…?
    - How much money does Johnny make if he saves for 10 weeks?

Student Application

- Pass out the T.V. Savings Graph (Resource 16 and 17, answer keys Resource 18 and 19) that is already labeled for the students. Explain to the students that they need to figure out when Johnny will be able to buy his television that costs $100.00. They will need to graph two lines on the graph. One line will be in red to show Johnny's earning $1 a day. The other line will be blue, which will stand for Johnny's earnings of $2 a day.   The teacher will be available to help students who are having trouble.
- Students will be given 10-15 minutes to complete the graph and answer the questions. The graph and questions should be handed in when students are finished. After all papers are collected the teacher will lead the discussion with the students answering and explaining all of the questions to ensure understanding.

Embedded Assessment
- Teacher should be looking for an understanding of patterns and the ability to identify the patterns created in the graph. This can be done through observation during group and individual work, discussion, and whole class responses. Also, the final graph and worksheet will be collected to identify how well the students grasped the concept.

Reteaching/Extension

- For those students who may be having trouble with finding answers for the graph you can help them extend their function table so that they can plot all the points on the graph. Now, they can just connect all the points to create the lines. To answer the questions they can then use both their completed graphs and their function tables that will also have the answers. Students can also be encouraged to help each other. Therefore, if a student is having trouble allow a student who understands the concept to work with him/her.
- For those students who need to be challenged allow them to make up their own scenario that uses a pattern. The student can then be encouraged to create their own function table and/or graph show the pattern that they create. Students can then switch with a partner and try to solve their pattern.
- If time permits, students may also complete the Extension Worksheet (Resource 20-22, answer key Resource 23).

Summative Assessment:

The students will complete the Summative Assessment which is in the form of the MSA. It consists of 5 selected responses and 1 brief constructed response (Resource 24 and 25, answer key Resource 26). Students will apply their knowledge of patterning, function tables, skip counting, and graphing.
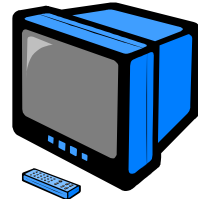
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Patterning Our Way To Savings

Johnny's parents pay him $1.00 for every day that he does his chores. He likes to do chores from Monday through Friday, but doesn't like to do them on the weekends! Last weekend at Best Buy, Johnny saw 4 items that he just had to have! They are listed below. Help Johnny figure out how long it will take him to save enough money for each item!

CD	DVD	PS2 Game	TV
$14.99	$19.99	$40.00	$100.00

January

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 No Chores	**2** No Chores	**3**
4	**5**	**6**	**7**	**8**	**9**	**10** **Total Week 1:**
11	**12**	**13**	**14**	**15**	**16**	**17** **Total Week 1&2:**
18	**19**	**20**	**21**	**22**	**23**	**24** **Total Week 1-3:**
25	**26**	**27**	**28**	**29**	**30**	**31** **Total Week 1-4:**

2004

Questions for January

1. How much money did Johnny save in the first week? _____

2. How much money did he save in two weeks? _____

3. In three weeks? _____   In four weeks? _____

4. Do you see a pattern in his savings? _____

5. Explain the pattern you see: _____

_____

_____

February

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7 **Total Week 1:**
8	9	10	11	12	13	14 Total Week 1&2:
15	16	17	18	19	20	21 **Total Week 1-3:**
22	23	24	25	26	27	28 **Total Week 1-4:**
29						

2004

Questions for February

1. How much money did Johnny save in the first week? _____

2. How much money did he save in two weeks? _____

3. In three weeks? _____ In four weeks? _____

4. Do you see a pattern in his savings? _____

5. Explain the pattern you see: _____

_____

_____

6. Now that you know the pattern, how much can Johnny save if he works one more week?

_____ Two more weeks? _____ Three more weeks? _____

7. How did knowing and using the pattern help you figure this out? _____

_____

_____

March

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6 **Total Week 1:**
7	8	9	10	11	12	13 **Total Week 1&2:**
14	15	16	17	18	19	20 **Total Week 1-3:**
21	22	23	24	25	26	27 **Total Week 1-4:**
28	29 No Chores	30 No Chores	31 No Chores			

2004

Questions for March

1. How much money did Johnny save in the first week? _____

2. How much money did he save in two weeks? _____

3. In three weeks? _____ In four weeks? _____

4. Do you see a pattern in his savings? _____

5. Explain the pattern you see: _____

_____

_____

6. Now that you know the pattern, how much can Johnny save if he works one more week?

_____ Two more weeks? _____ Three more weeks? _____

7. How did knowing and using the pattern help you figure this out?

_____

_____

8. How was this pattern different from the patterns in January and February?_____

_____

_____

_____

Answer Keys

Questions for January:
1. $5.00
2. $10.00
3. $15.00, $20.00
4. Yes
5. Student should write that they see a pattern in the savings that skip counts by fives for each week.

Questions for February:
1. $5.00
2. $10.00
3. $15.00, $20.00
4. Yes
5. Student should write that they see a pattern in the savings that skip counts by fives for each week.
6. $25.00, $30.00, $35.00
7. Student should write that counting by fives allowed him or her to calculate savings for future weeks without the use of a calendar.

Questions for March:
1. $10.00
2. $20.00
3. $30.00, $40.00
4. Yes
5. Student should write that they see a pattern in the savings that skip counts by tens for each week.
6. $50.00, $60.00, $70.00
7. Student should write that counting by tens allowed him or her to calculate savings for future weeks without the use of a calendar.
8. This pattern skip counted by tens rather than fives.

On the next page, you will find a completed student calendar that models how to fill it in.

January

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 No Chores	**2** No Chores	**3**
4	**5** $1.00	**6** $1.00	**7** $1.00	**8** $1.00	**9** $1.00	**10** **Total Week 1:** $5.00
11	**12** $1.00	**13** $1.00	**14** $1.00	**15** $1.00	**16** $1.00	**17** **Total Week 1&2:** $10.00
18	**19** $1.00	**20** $1.00	**21** $1.00	**22** $1.00	**23** $1.00	**24** **Total Week 1-3:** $15.00
25	**26** $1.00	**27** $1.00	**28** $1.00	**29** $1.00	**30** $1.00	**31** **Total Week 1-4:** $20.00

Name: _____

<u>Function Tables and Patterns</u>

January:

Week	Total Money Saved

Was it easier to fill out the calendar or the function table?

Why? _____

_____

_____

How long did it take Johnny to save enough money to

purchase a DVD? _____ How do you know?

_____

_____

February:

Week	Total Money Saved

What is the pattern in this table? _____

After saving for just the month of February, what can

Johnny purchase? _____

How many weeks did it take Johnny to save enough to

purchase this item? _____

How do you know? _____

_____

_____

Week	Total Money Saved

March:

What is the pattern during the month of March? _____

After saving for just the month of March, what can Johnny

purchase? _____

How many weeks did it take Johnny to save enough money to

purchase this item? _____

How do you know? _____

_____

How did knowing and using a pattern help you fill in the table?

_____

_____

_____

Using what you know about function tables and patterns, fill in the table showing two more weeks of savings.

Answer Key:

<u>January</u>:

It was easier to fill out the function table because I knew the pattern so I didn't have to fill out every day on the calendar. I was just able to count by fives. It took Johnny 4 weeks to save the money because I counted by 5 four times and got 20.
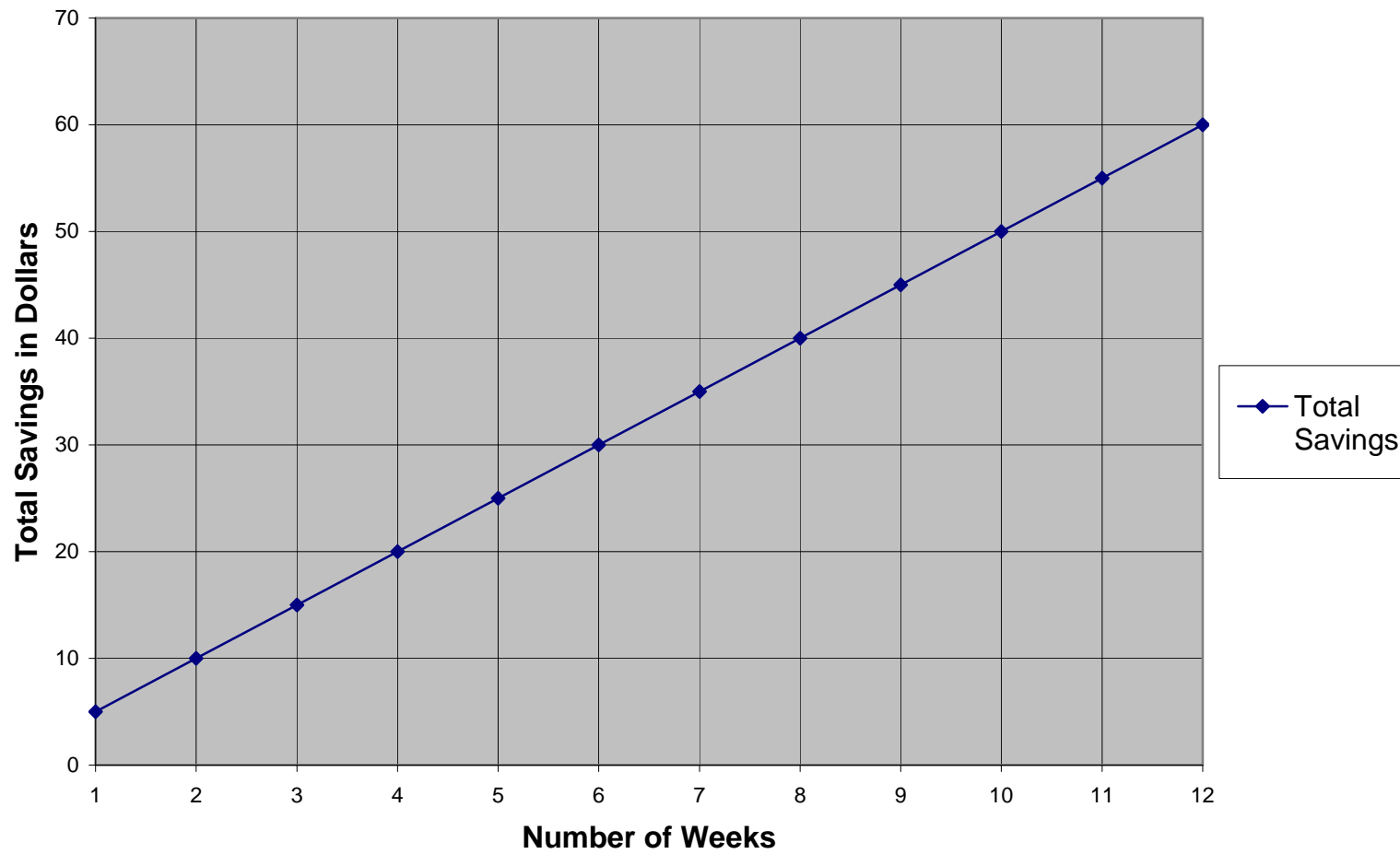
<u>February</u>:

The pattern in this table is counting by fives. Johnny can purchase a CD and it took him 3 weeks. I know this because on the table I saw he earned $15.00 after 3 weeks of saving.
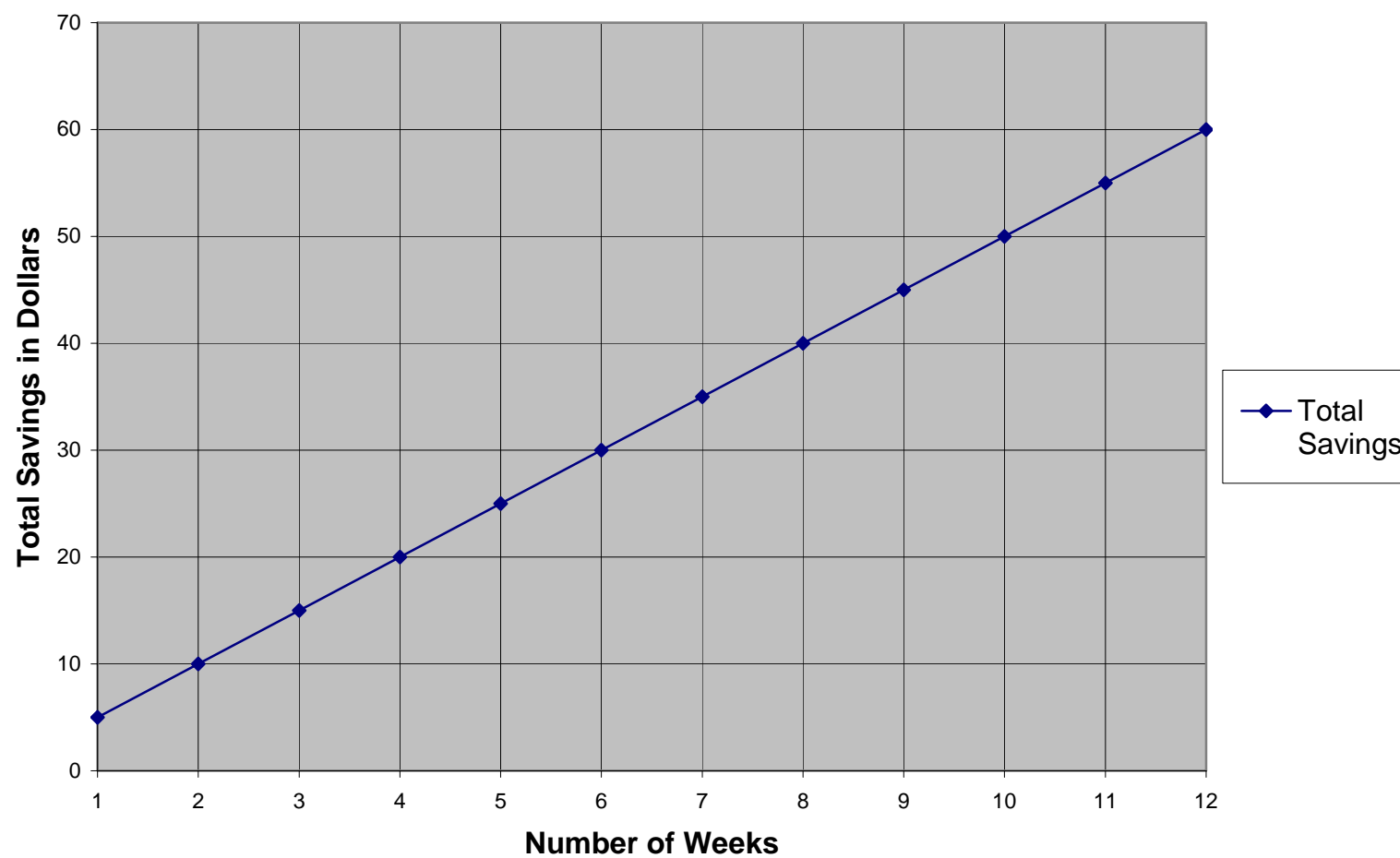
<u>March</u>:

The pattern during March was increasing by $10.00 and Johnny can purchase a PS2 game. It took him 4 weeks to save enough money because I saw on the graph that he earned 10 more dollars each week and after 4 weeks he had $40.00. By using a pattern I was able to fill in the table by counting by tens instead of filling out a calendar. I knew each week he earned 10 more dollars which is why I counted by tens.

Teacher Graph for January Total Savings

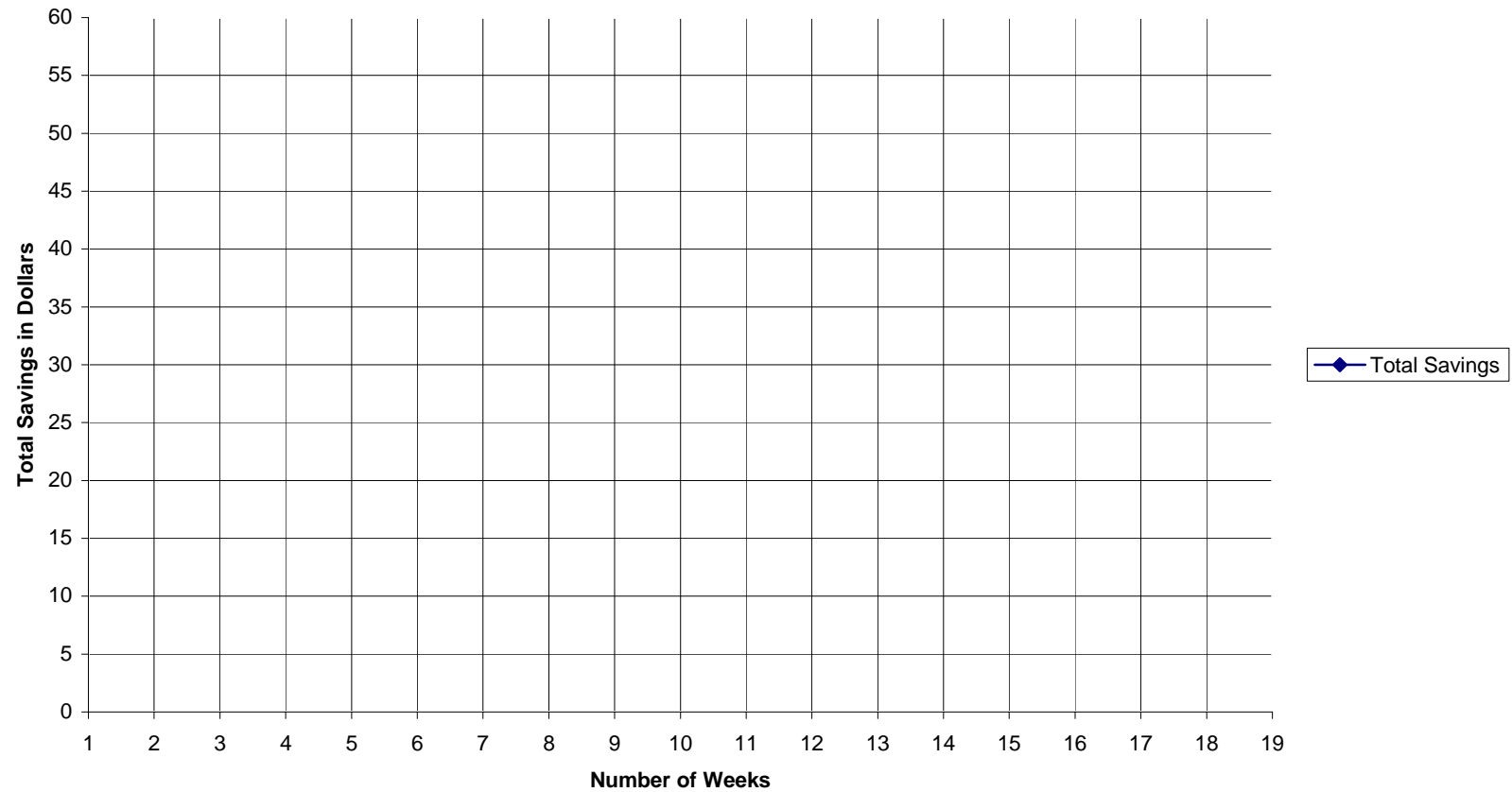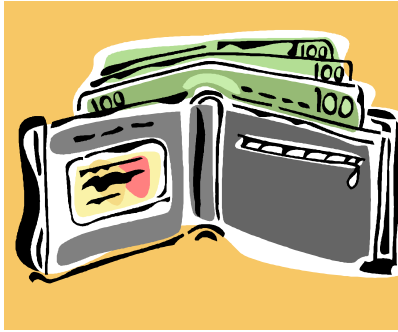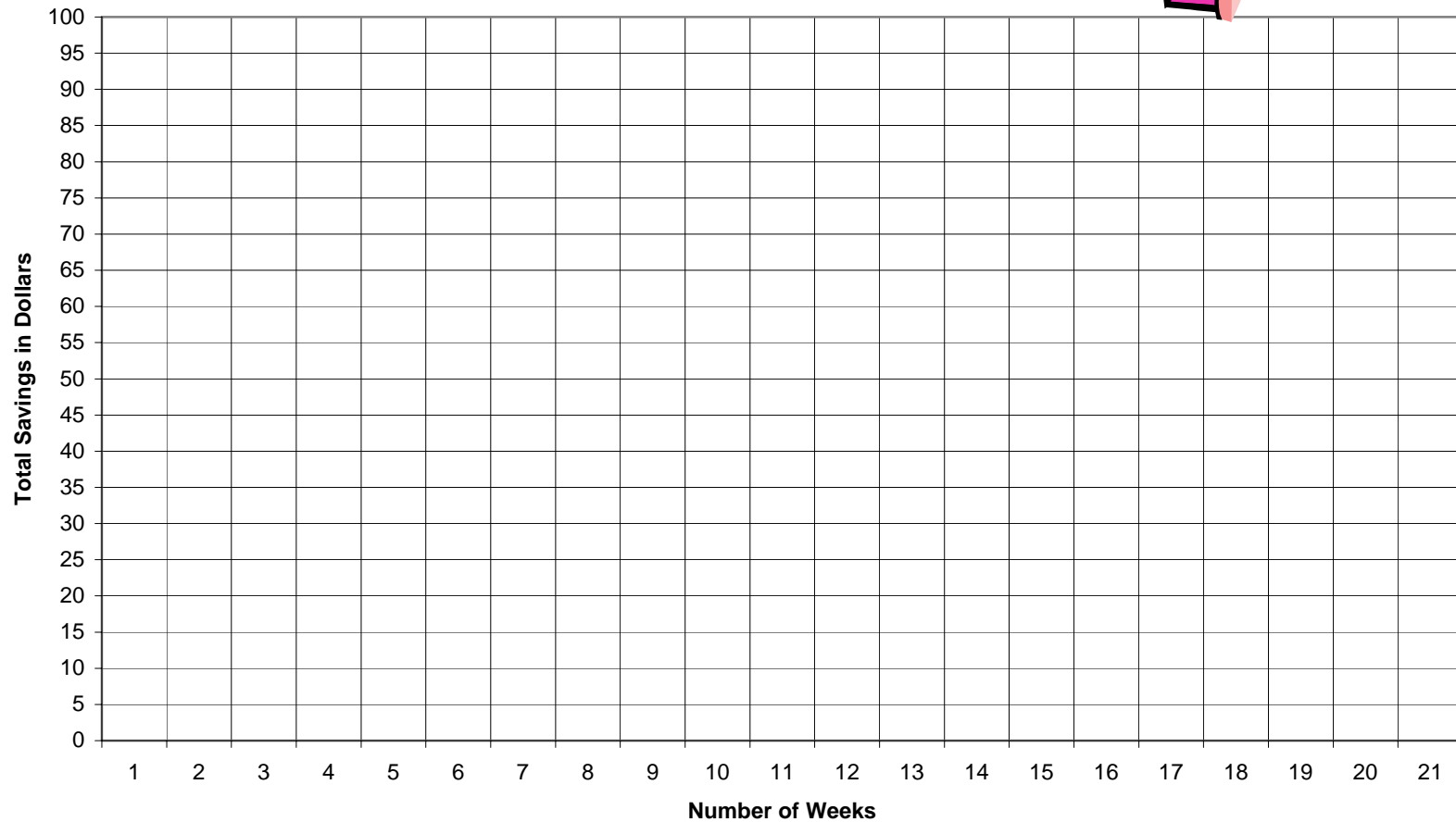**Total Savings in Dollars** (y-axis)

Number of Weeks (x-axis)

Legend: Total Savings

Teacher Graph for February Total Savings

Total Savings in Dollars (y-axis)

Number of Weeks (x-axis)

Legend: Total Savings

Total February Savings

Total Savings in Dollars

60
55
50
45
40
35
30
25
20
15
10
5
0

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Number of Weeks

Total Savings

Total Savings for a T.V.

Total Savings in Dollars

100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

Number of Weeks
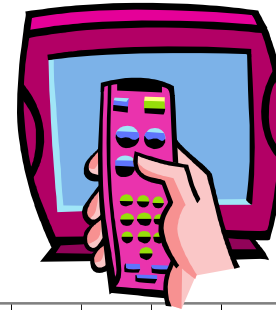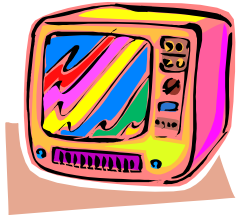
Questions for T.V. Savings

1. How many weeks does it take Johnny to save $100.00 when he earns $1.00 a

   day?_____How do you

   know?_____

   _____

2. How many weeks does it take Johnny to save $100.00 when he earns $2.00 a

   day?_____How do you

   know?_____

   _____

3. Why does it take Johnny less time to save $100.00 when he is making $2.00 a day instead of

   $1.00 a day? Use what you know about <u>patterns</u> to answer the question!

   _____

   _____

   _____

Answers for T.V. Savings Worksheet

1. 20 weeks . I know by looking at the graph. The line on the graph shows that when Johnny earns $1 a day he will take 20 weeks to earn enough money for his t.v.

2. 10 weeks . I know by looking at the graph. The line on the graph shows that when Johnny earns $2 a day he will take 10 weeks to earn the money for his t.v.

3. It takes Johnny less time because the pattern shows that when Johnny earns $2 a day the savings increases each week by $10. However, when Johnny only earns $1 a day the savings increases each week by $5.

Total Savings For a T.V.

Total Savings Earning $1 per day
Total Savings Earning $2 per day
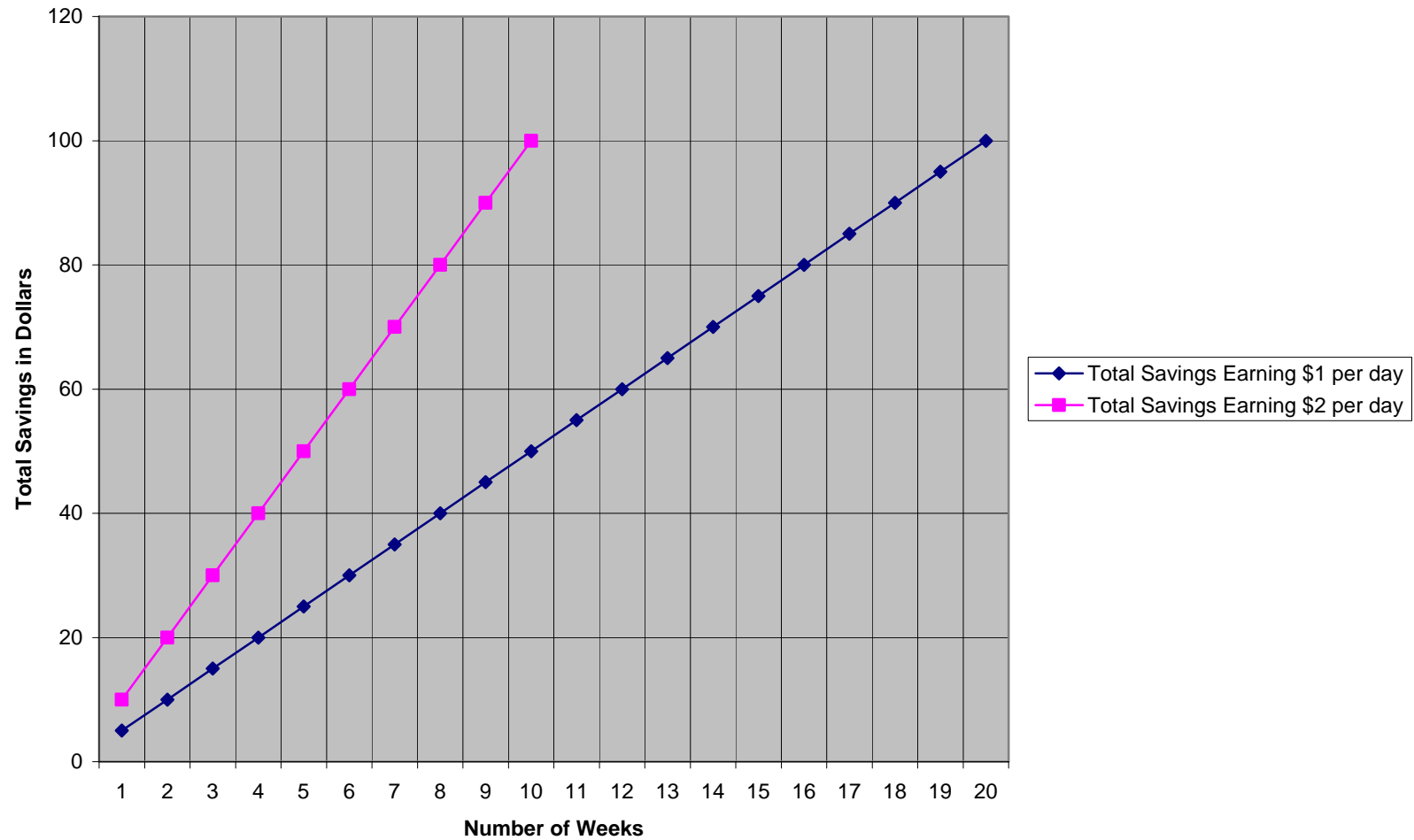
Name: _____   **Date:** _____

Patterns: Extension Activity

Directions: Read the prompt below, and answer the questions

that follow!

Prompt: Every day at your school, your teacher gives out two

stickers per day for positive behavior. You **always** receive both

of the stickers because you are such a great student! In the

steps below, answer the questions using the information you have

been given.

1. Fill out this function table showing the total number of

stickers you would receive in **five days**.

(Monday through Friday)

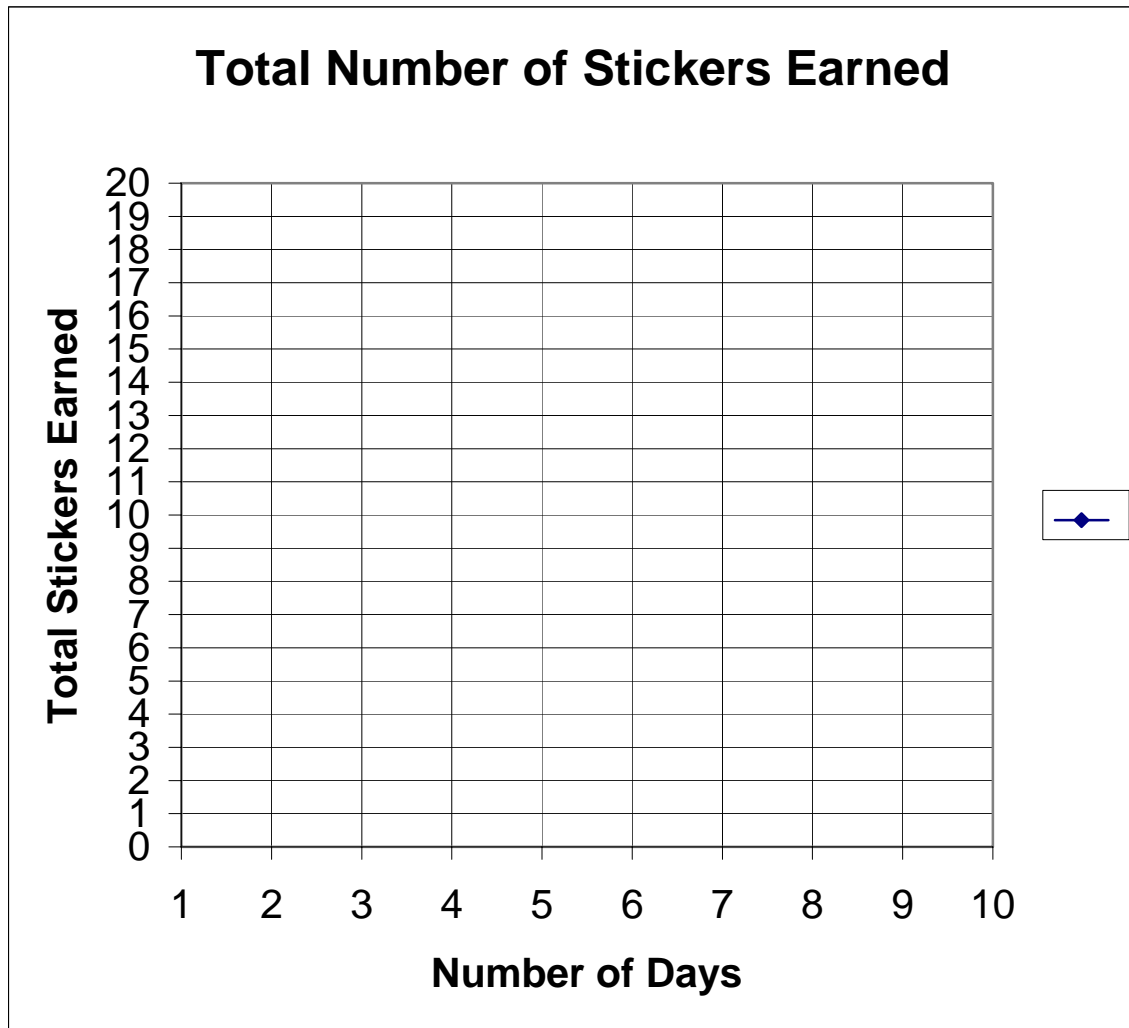2. What is the pattern in this table?

_____

3. How many stickers did you earn in

five days? _____

4. How many stickers did you earn by

the third day? _____ How do you know? _____

_____

5. If you earned two more stickers per day for five **more** days,

how many stickers would you have total then? _____

Day	Total Number of Stickers

6. Explain how you figured out your answer using words and

numbers, as well as what you have learned about patterns.

_____

_____

_____

_____

Next, graph the function table you created above on the graph

below.

Total Number of Stickers Earned

Total Stickers Earned

20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0

1   2   3   4   5   6   7   8   9   10

Number of Days

7. Now that you know the pattern of the graph, extend the graph
to show 5 more days of earning stickers.

8. How does the graph you created prove that there is a pattern
in your results? Use what you have learned about patterns to
answer the question. _____

_____

_____

_____

_____

_____

_____
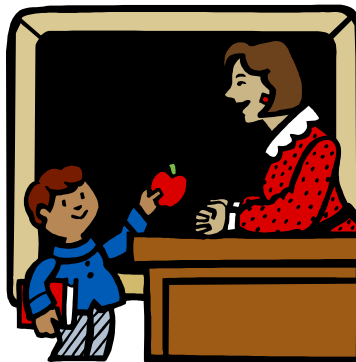
Answer Key: Summative Assessment

2. The pattern skip counts by 2.

3. I earn 10 stickers.

4. By the third day, I earned 6 stickers. I knew by using the pattern and counting by two's 3 times.

5. You would have 20 stickers after 10 days.

6. I figured this out by using the pattern of counting by two's. I counted by two's five more times giving me 20 stickers.

Day	Total Number of Stickers
1	2
2	4
3	6
4	8
5	10

Total Number of Stickers Earned
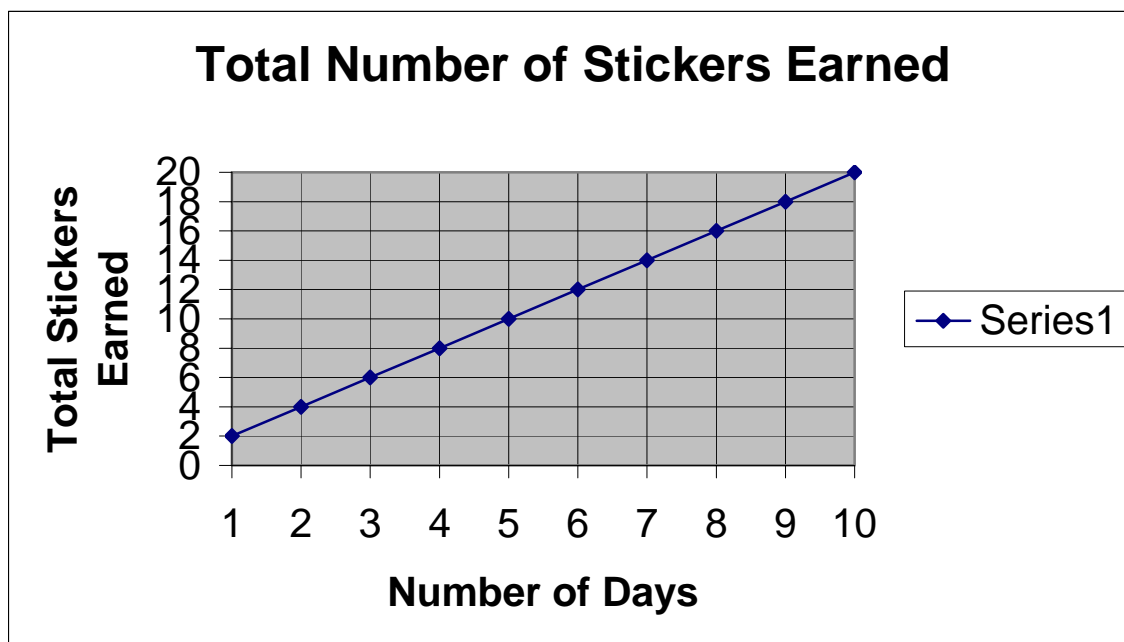
8. I know that this is a pattern because a pattern repeats itself and my numbers go up by two each time. The line also goes up in a straight line because it is increasing by the same amount.

Name: _____   **Date: _____**

Summative Assessment

Refer to the function table in order to answer questions 1-3.

1. In the function table, what number belongs in the ☐ ?
   a. $3.00
   b. $5.00
   c. $6.00
   d. $10.00

Total Amount of Money Earned

Day	Money Earned
1	$2.00
2	$4.00
3	☐
4	$8.00

2. What is the pattern in the function table?
   a. subtract four
   b. add two
   c. multiply by four
   d. divide by two

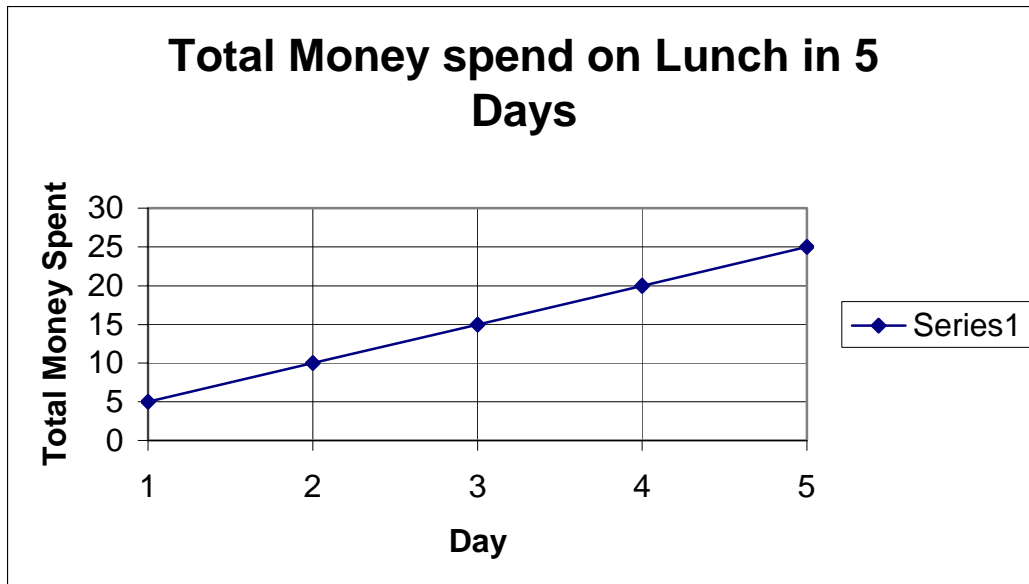3. If the function table continued, how much money would be earned on the 7th day?
   a. $35.00
   b. $12.00
   c. $15.00
   d. $14.00

Explain how you figured out your answer using words and numbers, as well as what you have learned about patterns.

_____

_____

_____

_____

Use the graph below to answer questions 4-5.

Total Money spend on Lunch in 5 Days

4. How much total money was spent on lunch by the 4th day?
   a. $20.00
   b. $25.00
   c. $40.00
   d. $21.00

5. What is the pattern of this graph?
   a. multiply by 10
   b. add 5
   c. divide by 10
   d. subtract 5

Answer Key – Summative Assessment

1. c

2. b

3. d, I figured this out by using the pattern of counting by two's.

    I counted by two's 3 more time giving me $14.00.

4. a

5. b